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GPS Decision Analysis Process

Nisha Shah

The Boeing Company

73rd MORS Symposium

US Military Academy – West Point

21-23 June 2005

GPS Decision Analysis Objectives



- Understand the Customer Value Structure in the Area of GPS-Related Military Tasks
 - Identify High Leverage Military Tasks for A Specific GPS Technology
 - Identify Important Military Tasks with Performance Gaps
 - Highlight Tasks for Which Competing Approaches Are Insufficient
- Identify Cost, Technical Risk and Political Risk Implications for Military Task Completion Using A Specific GPS Technology

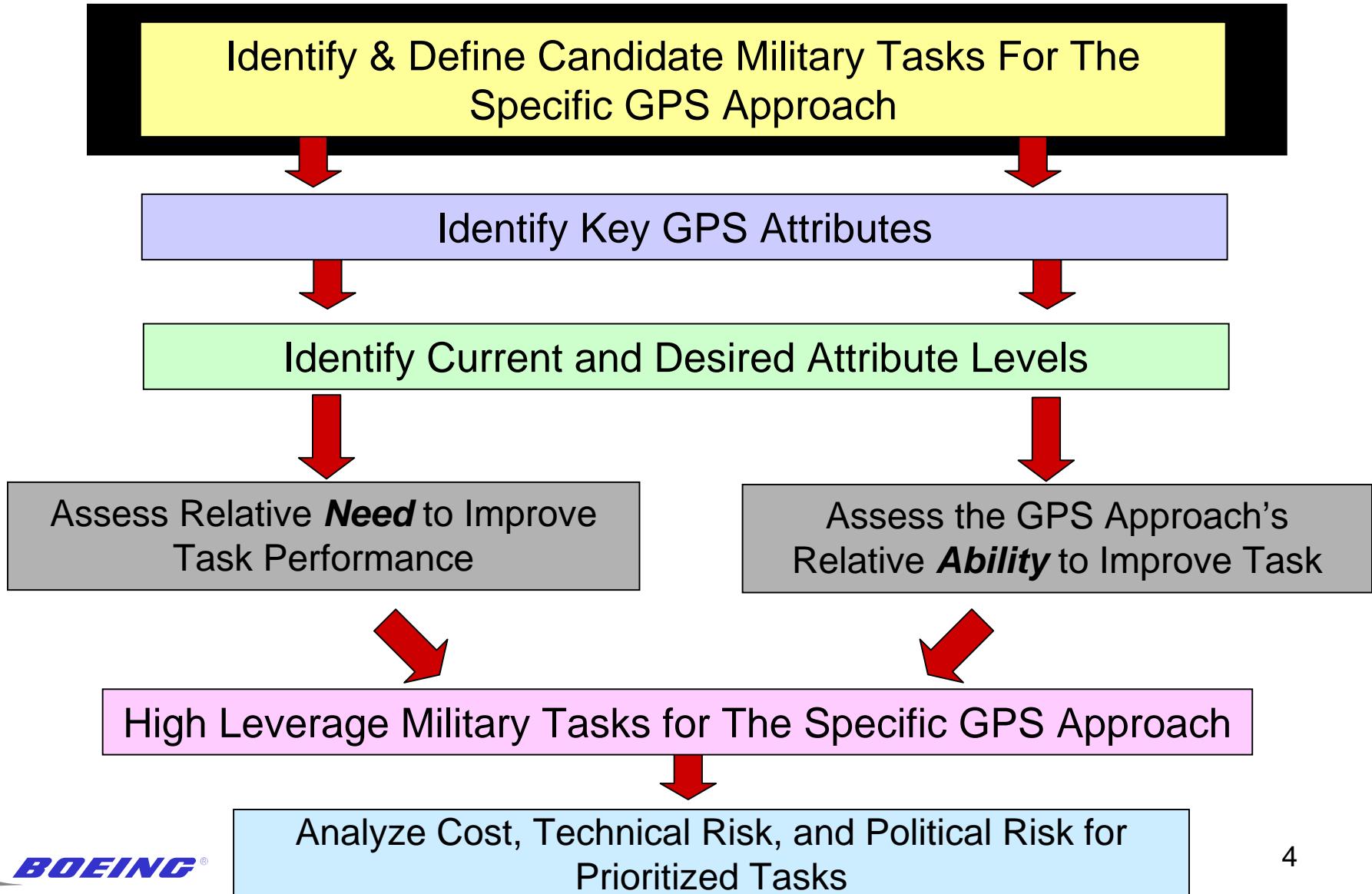
Maintain a Non-Advocate Perspective. All Decisions Made Throughout the Process Were Based On Consensus.

GPS Decision Analysis Approach



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Strategic Development & Analysis





Military Tasks

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- Precisely Navigate In Urban/Low-Signal Settings
 - Precisely Navigate Weapons From Airborne Assets
 - Precisely Navigate Weapons From Ground-Based Assets
 - Precisely Locate Urban Targets
- • • •

Notional

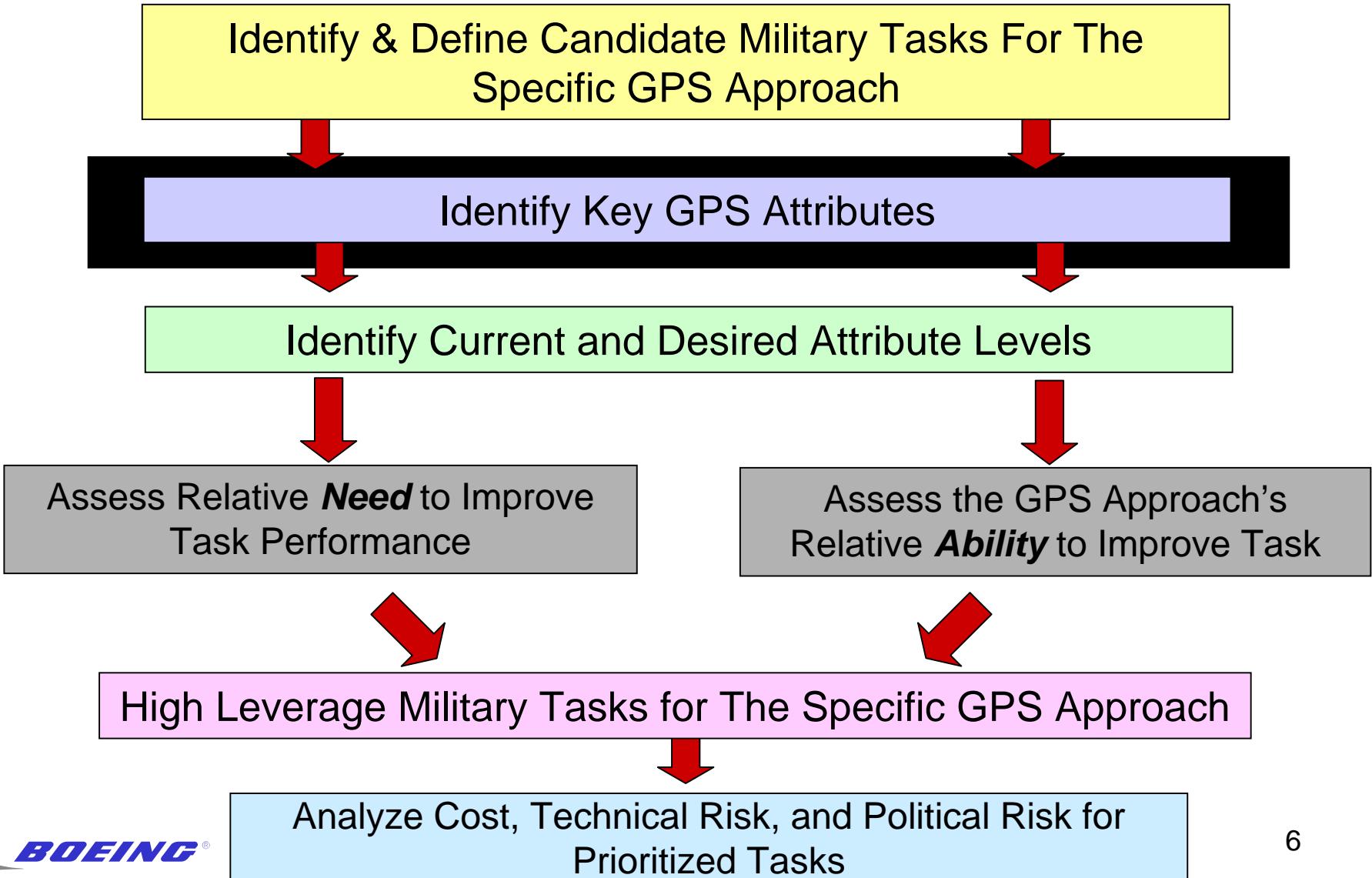
The Results of a Internal Survey of Subject Matter Experts Were Compiled, and Later Reviewed and Revised to Create the List of Potential Military Tasks for The Specific GPS Technology

GPS Decision Analysis Approach



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Attributes

- Attributes Represent Different GPS-Related Performance Parameters
 - Attribute A
 - Attribute B
 - Attribute C
 - Attribute D
 - Attribute E
 - Attribute F
- Performance Levels (1-5) For Each Attribute Were Defined For Each of the GPS Approaches
- A Performance Level of 5 Represented Highest Possible Performance In Terms of the Given Attribute
- A Performance Level of 1 Represented Lowest Possible Performance In Terms of the Given Attribute

For Example, Accuracy May Be A Key GPS-Related Performance Parameter. Our Specific GPS Technology May Reach a Performance Level of 5 In Terms of Accuracy.

Attribute Performance Levels



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The Attribute Performance Levels for Our Specific Approach and Competing Approaches Were Defined

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1

Notional

The Above Table Shows the Attribute Performance Levels For Our Specific GPS Approach As Well As For Competing Approaches. Competing Approaches Include Both Options That Are Currently Operational And Those That Will Be Operational In the Near Future

GPS Decision Analysis Approach



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Identify & Define Candidate Military Tasks For The Specific GPS Approach

Identify Key GPS Attributes

Identify Current and Desired Attribute Levels

Assess Relative **Need** to Improve Task Performance

Assess the GPS Approach's Relative **Ability** to Improve Task

High Leverage Military Tasks for The Specific GPS Approach

Analyze Cost, Technical Risk, and Political Risk for Prioritized Tasks

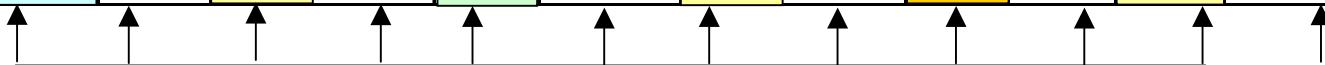
Current and Desired Attribute Levels



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Task	Current Approach	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
		Current Level	Desired Level										
Precisely Navigate in Urban/Low Signal Settings	Competing Approach 6	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4



What Is/The Desired Attribute Level?

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1

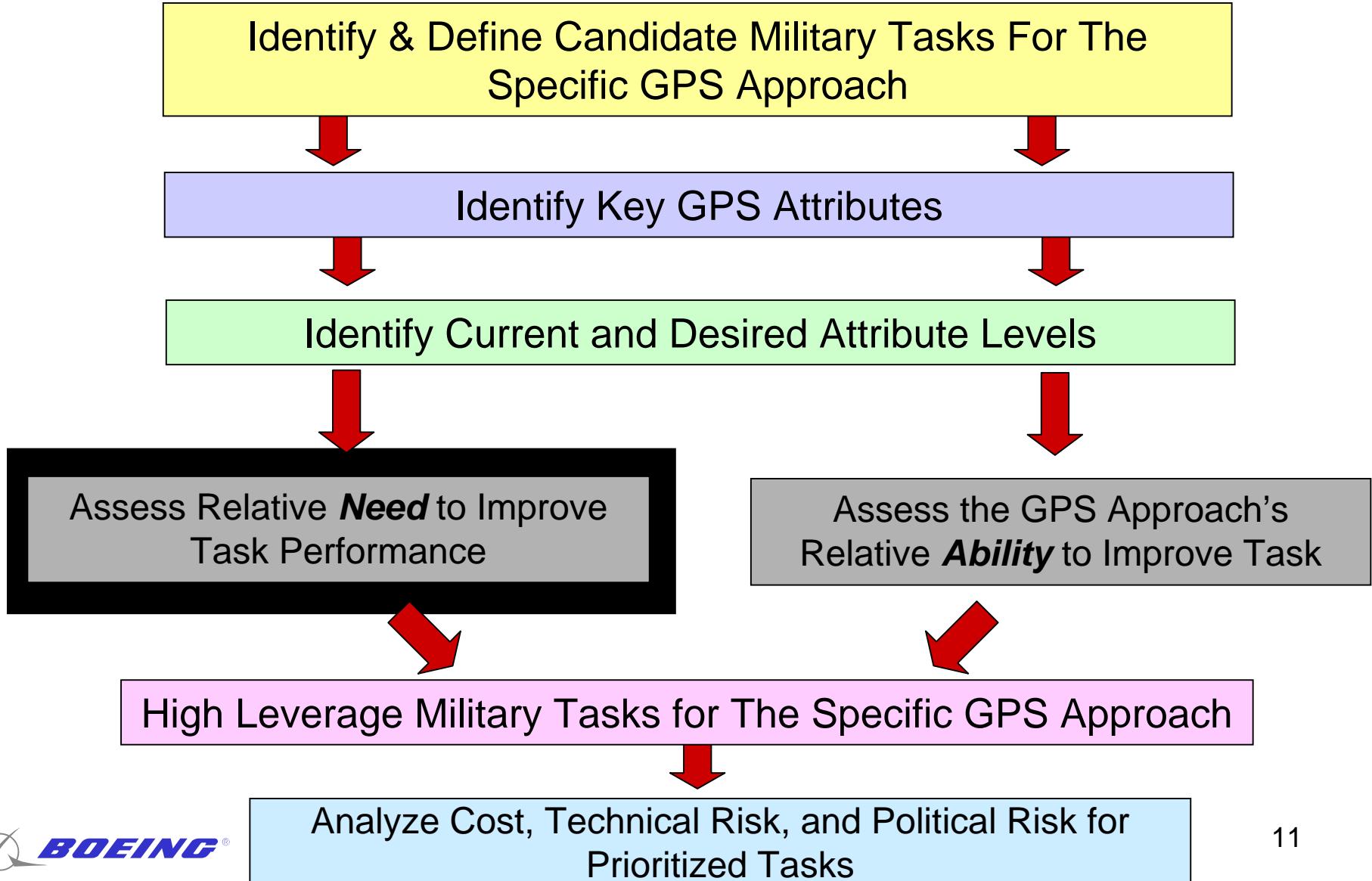
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GPS Decision Analysis Approach



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Relative Need For Task Improvement



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Task	Implicit Importance of Task	Gap Between Current and Desired Capabilities	Relative Need For Task Improvement
Precisely Navigate in Urban/Low Signal Settings	M	M	M

Based on Both the Implicit Importance and the Gap Between Current and Desired Capabilities, What Is the Overall Relative Need for Task Improvement?

From the Perspective of the JFC, What Is the Implicit Importance of "Precisely Navigate in Urban/Low Signal Settings?"

What Is the Gap Between Current and Desired Capabilities in the Area of "Precisely Navigate in Urban/Low Signal Settings?"

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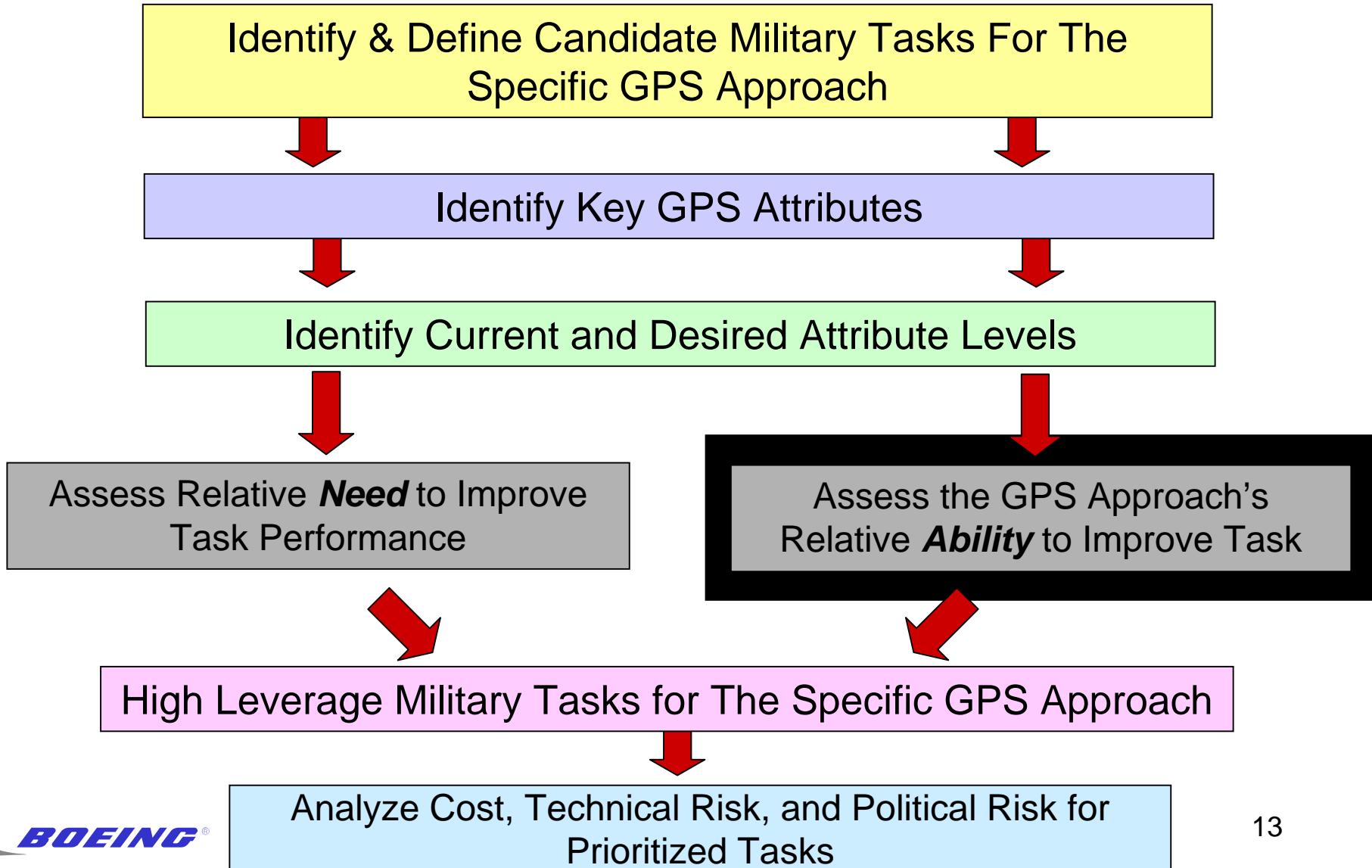
Task	Current Approach	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
		Current Level	Desired Level										
Precisely Navigate in Urban/Low Signal Settings	Competing Approach 6	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4

GPS Decision Analysis Approach



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Relative Ability of Specific GPS Approach



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Precisely Navigate In Urban/Low Signal Settings

	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Desired Attribute Level	PL 2	PL 4	PL 5	PL 4	PL 5	PL 4

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For This Task, Can the GPS Approach Perform to the Desired Attribute Level?

	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F	Sum "yes"
Specific GPS Approach	yes	yes	yes	no	no	yes	4
Competing Approach 1	yes	no	no	no	no	no	1
Competing Approach 2	yes	yes	no	no	no	no	2
Competing Approach 3	yes	no	no	no	no	no	1
Competing Approach 4	yes	no	no	no	no	no	1
Competing Approach 5	yes	yes	no	yes	no	no	3
Competing Approach 6	yes	no	no	no	no	no	1
Competing Approach 7	yes	no	no	no	no	no	1
Competing Approach 8	yes	no	no	no	no	no	1

Best Approach

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	R1.5	R1.5	R1.5	R1.3	R1.4	R1.5
Competing Approach 1	R1.5	R1.3	R1.2	R1.3	R1.2	R1.1
Competing Approach 2	R1.5	R1.5	R1.4	R1.2	R1.3	R1.3
Competing Approach 3	R1.3	R1.2	R1.3	R1.3	R1.2	R1.3
Competing Approach 4	R1.2	R1.2	R1.1	R1.3	R1.2	R1.3
Competing Approach 5	R1.3	R1.5	R1.1	R1.5	R1.2	R1.1
Competing Approach 6	R1.2	R1.3	R1.1	R1.3	R1.4	R1.3
Competing Approach 7	R1.5	R1.5	R1.4	R1.4	R1.3	R1.3
Competing Approach 8	R1.5	R1.3	R1.2	R1.3	R1.2	R1.1

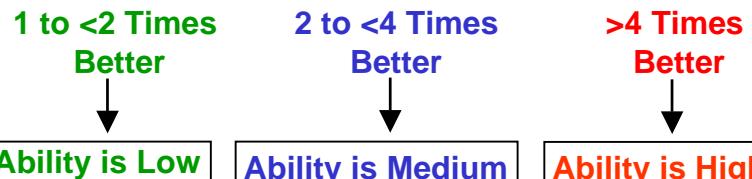
Next Best Approach

Number of Attributes That The Specific GPS Approach Can Perform to the Desired Level

$$\frac{4}{3} = 1.33$$

Number of Attributes That The Next Best Approach Can Perform to the Desired Level

How Much Better is The Specific GPS Approach Than the Next Leading Approach?



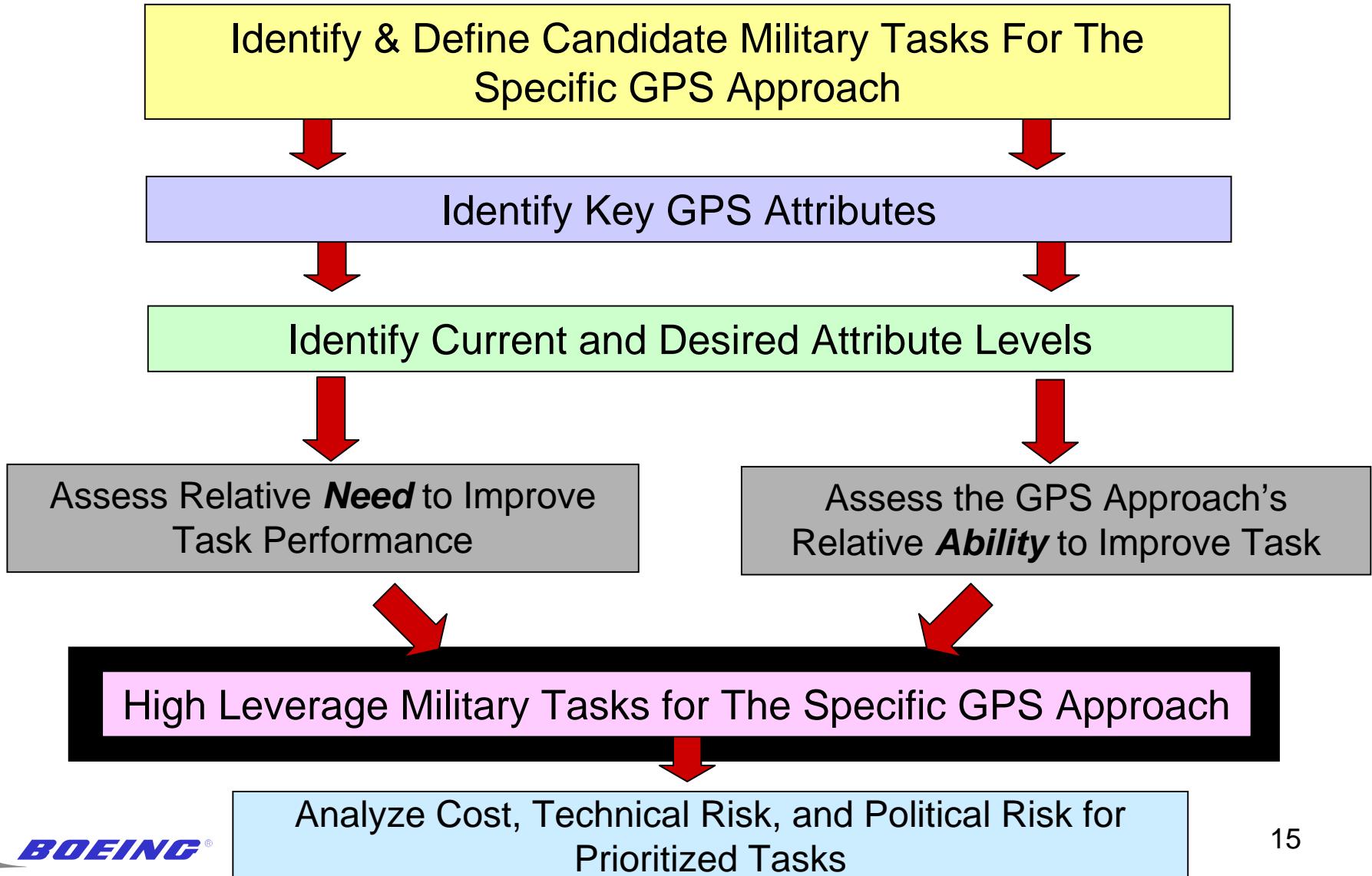
Relative Ability is Low

GPS Decision Analysis Approach



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Military Task Prioritization

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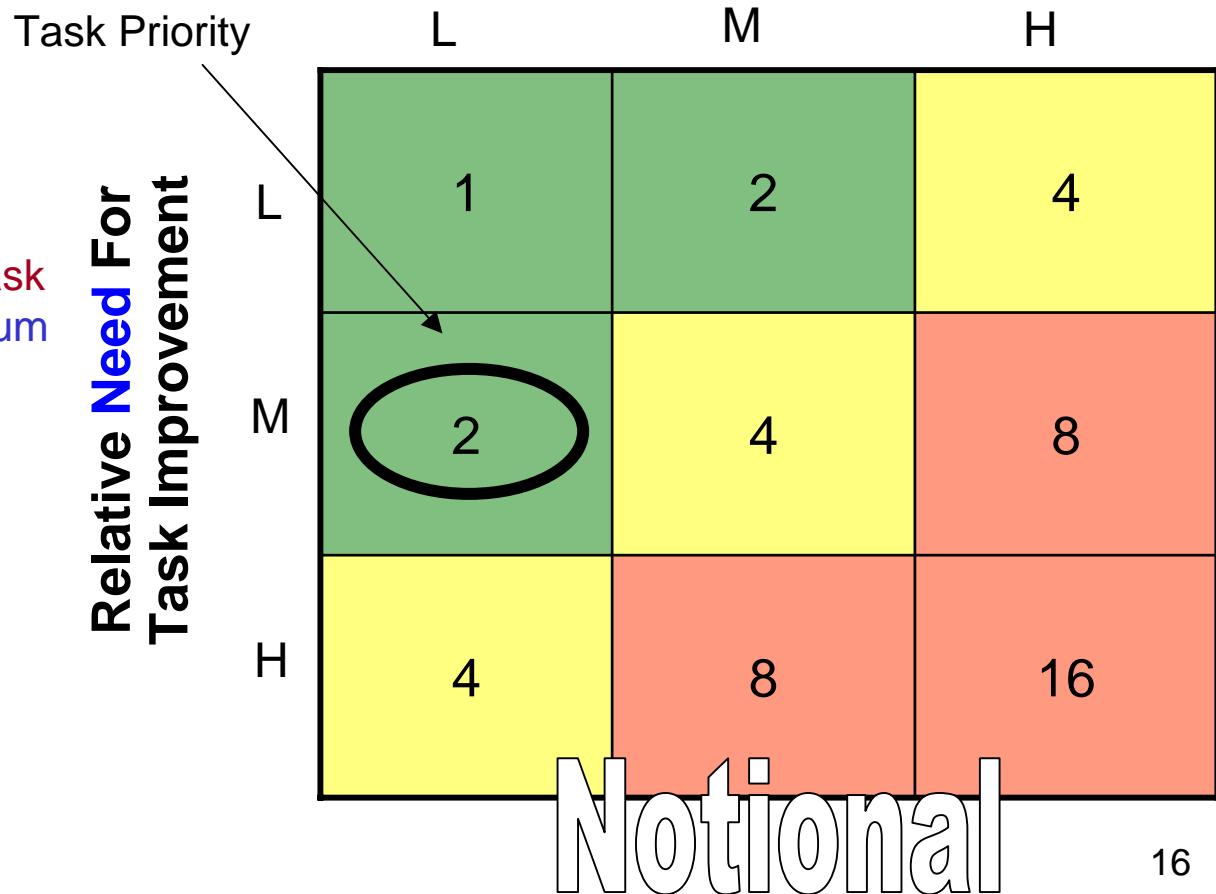
Precisely Navigate in Urban/Low Signal Settings

Relative Need For Task Improvement is Medium

Grid Emphasizes Tasks For Which There Exists A High Relative Need For Task Improvement and Our Specific GPS Approach Has a High Relative Ability to Improve.

Relative Ability For Approach to Improve Task is Low

Relative Ability

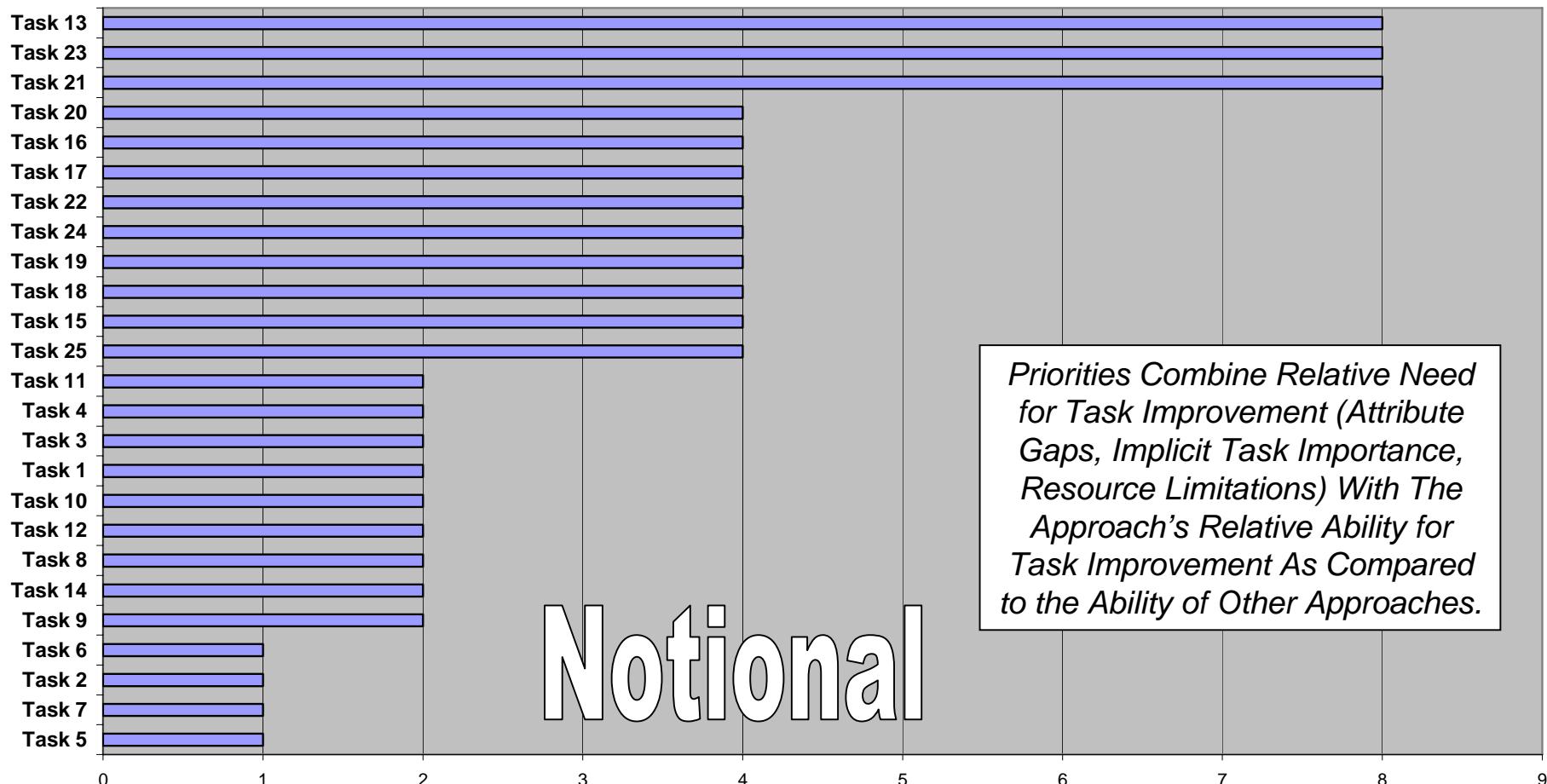


Prioritized Military Tasks For Specific GPS Technology



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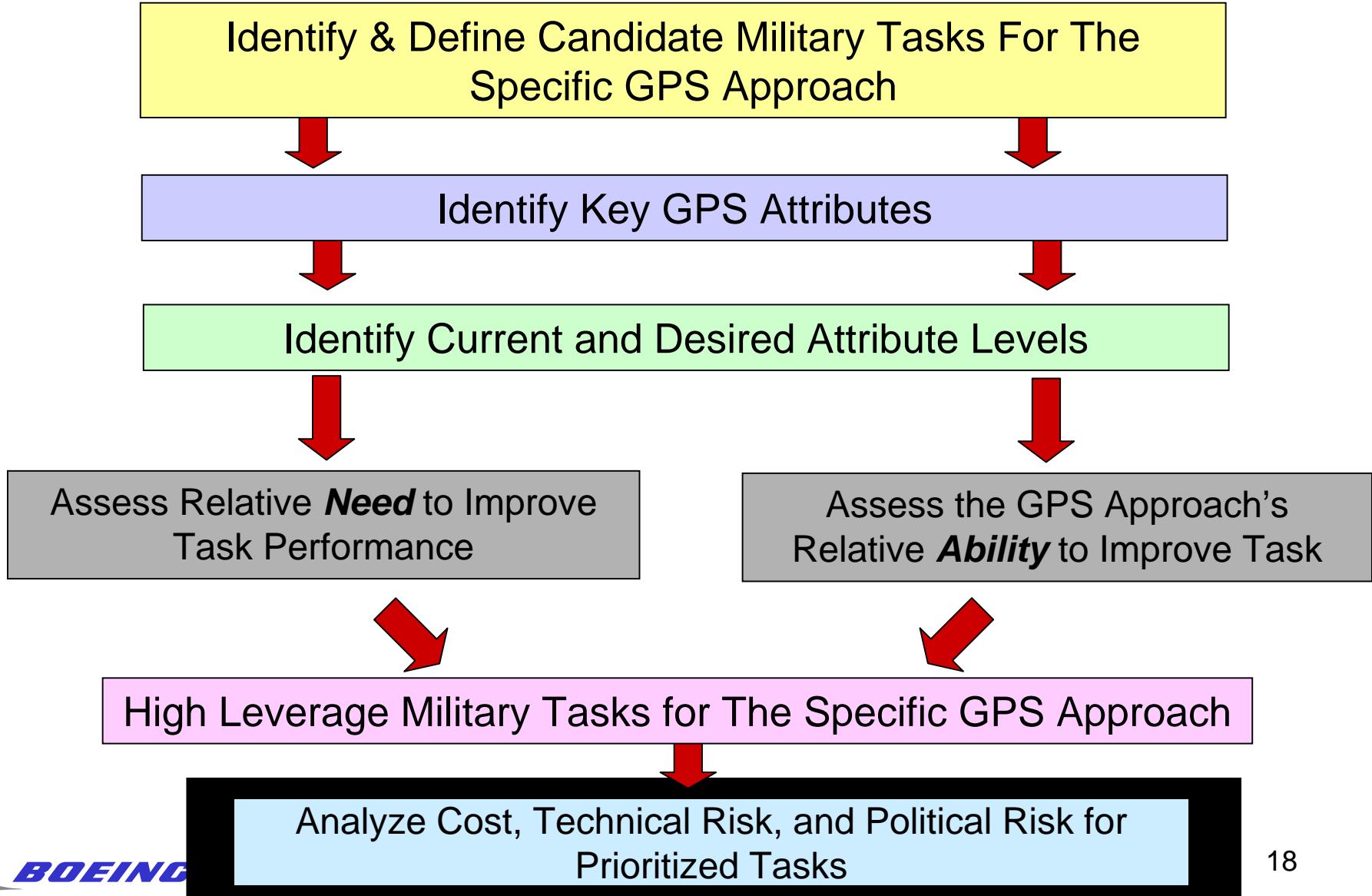
Task Priorities Are Relative to Each Other And Are the Result of a Facilitated Decision Analysis Process

GPS Decision Analysis Approach



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Cost, Technical Risk and Political Risk



Precisely Navigate in Urban/Low Signal Settings:

- What Level Of Technical Risk Is Associated With Task Performance With Our Specific GPS Approach?

Low

- What Level Of Political/Regulatory Risk Is Associated With Task Performance With Our Specific GPS Approach?

Medium

- What Level Of Relative Cost Is Associated With Task Performance With Our Specific Approach?

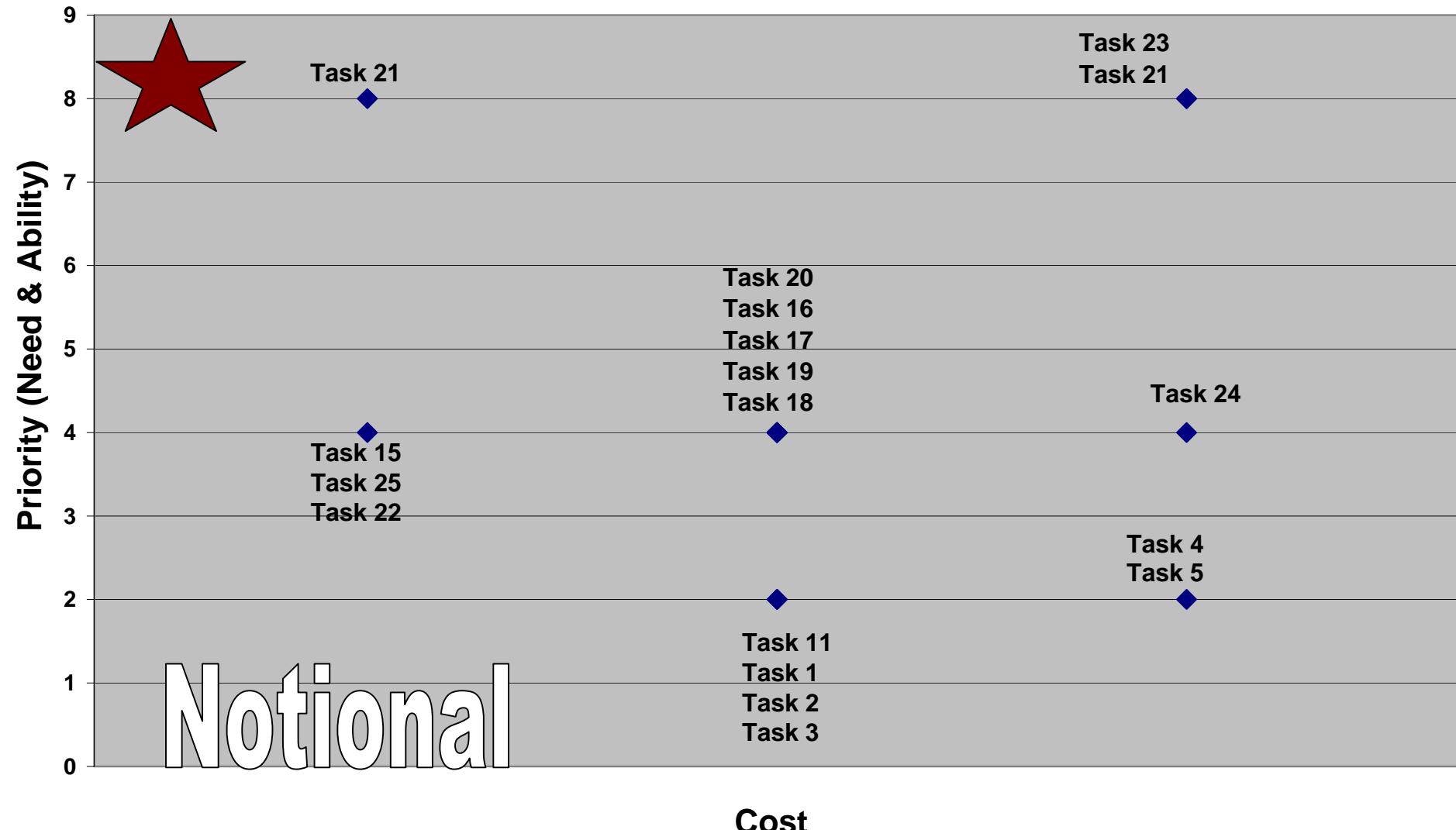
High

Military Tasks and Cost



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Conclusions

- Process Aided in Understanding the Customer Value Structure in the Area of GPS-Related Military Tasks
- Process Aided In Identifying Areas For Further, More In-Depth Research
- Process Allowed For a Top-Level Assessment of Technical Risk, Political Risk, and Cost
- GPS Technologists Utilized the Results of This Activity To Further Analyze the Performance of High Priority Military Tasks Using the Specific GPS Approach



Questions

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Backup

Current And Desired Attribute Levels



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Precisely Navigate in Urban/Low Signal Settings

<u>Current Approach</u>	Attribute A		Attribute B		Attribute C		Attribute D		Attribute E		Attribute F	
Competing Approach 6	Current Level	Desired Level										
	PL 2	PL 2	PL 3	PL 4	PL 1	PL 5	PL 3	PL 4	PL 4	PL 5	PL 3	PL 4

↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

What is the Desired Attribute Level?

Approach	Attribute A	Attribute B	Attribute C	Attribute D	Attribute E	Attribute F
Specific GPS Approach	PL 5	PL 5	PL 5	PL 3	PL 4	PL 5
Competing Approach 1	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1
Competing Approach 2	PL 5	PL 5	PL 1	PL 2	PL 2	PL 1
Competing Approach 3	PL 3	PL 2	PL 3	PL 3	PL 2	PL 3
Competing Approach 4	PL 2	PL 2	PL 1	PL 3	PL 2	PL 3
Competing Approach 5	PL 3	PL 5	PL 1	PL 5	PL 2	PL 1
Competing Approach 6	PL 2	PL 3	PL 1	PL 3	PL 4	PL 3
Competing Approach 7	PL 3	PL 3	PL 3	PL 3	PL 2	PL 3
Competing Approach 8	PL 5	PL 3	PL 2	PL 3	PL 2	PL 1